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(Reaffirmed 2006)

Indian Standard

METHOD OF TEST FOR DETERMINING SHEAR STRENGTH OF METALS

(First Revision)

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INDIAN STANDARDS INSTITUTION
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

April 1980

Indian Standard

METHOD OF TEST FOR DETERMINING SHEAR STRENGTH OF METALS

(First Revision)

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Indian Standard

METHOD OF TEST FOR DETERMINING SHEAR STRENGTH OF METALS

(First Revision)

0. FOREWORD

0.1 This Indian Standard (First Revision) was adopted by the Indian Standards Institution on 22 August 1979, after the draft finalized by the Methods of Physical Tests Sectional Committee had been approved by the Structural and Metals Division Council.

0.2 This standard was first published in 1969 for establishing a uniform practice for determining shear strength of mild steel. This was taken up for review by the Committee and is now being issued as a revised standard, with its scope being modified to include all metals.

0.3 The results of shear tests are greatly dependent upon the specimen geometry and the lengths of specimen which are sheared and those which are supported. The results of tests made in accordance with this method should not be directly compared with those determined in other types of tests in which the methods of loading and supporting the specimens are different.

0.4 This method is intended solely for the shear testing of cylindrical products like cold-heading wires, rods, rivets and pins and is not generally recommended for the determination of the shear strength of other products. The results of shear tests on specimens machined from other than cylindrical products may be greatly dependent upon the orientation of the specimen within the original test material, and the direction in which the load is applied relative to the grain flow in the original material. Therefore, if this method is used in the shear testing of other products, these variables should be identified and controlled.

0.5 In reporting the result of a test made in accordance with this standard, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS : 2-1960*.

*Rules for rounding off numerical values (*revised*).

1. SCOPE

1.1 This standard prescribes the method for shear testing of cylindrical metallic products, like cold-heading wire and rods, rivets and pins.

2. TERMINOLOGY

2.1 For the purpose of this standard, the definitions given in IS : 5069-1969* shall apply.

3. PRINCIPLE OF TEST

3.1 Shear strength is determined by inserting a cylindrical specimen through round holes in three hardened steel blocks, the centre of which is pulled (or pushed) between the other two so as to shear the specimen on two planes. The test consists of subjecting a suitable length of cylindrical specimen to double shear loading using a suitable test rig in a testing machine under a compressive load or tensile pull and recording the maximum load F to fracture. The maximum load divided by the combined cross-sectional area of the two planes is the shear strength, which shall be calculated from the following formula:

$$Rs = \frac{F}{2 \times \frac{\pi d^2}{4}} = \frac{2F}{\pi d^2}$$

where d is the actual diameter of the specimen.

4. TEST SPECIMENS

4.1 Specimen for this test shall consist of short lengths of wire, rod, rivets or pins having diameters within 0·05 mm of the holes in the testing rig. The minimum length of the specimen should be twice the diameter, the maximum length is not specified, as it has no particular effect on the result of the test.

4.2 Shear test specimen shall normally be of full cross section for cylindrical metallic products up to and including 25 mm in diameter, except that sizes in between two bush sizes shall be turned down to the next smaller bush size.

4.3 In the case of cylindrical products over 25 mm in diameter, the sample may be turned down to a specimen of 25 mm diameter for testing.

*Glossary of terms relating to methods of mechanical testing of metals.

5. METHOD OF TEST

5.1 Testing Machine — The testing machine, used in determination of shear strength, when verified in accordance with IS : 1828-1975* shall conform to the requirements of Grade 10.

5.2 Testing Rig — For conducting shear tests, a suitable steel shackle based upon fork-end and eye-plate principle may be used. The specimen is inserted as a connecting pin in the bush housing between the shackles, the fork plates of the shackle held rigidly together by bolts for avoiding any bending tendency of the specimen under high loads and tested in double shear. The nuts shown on either side of the forked shackle are used only for positioning and tightly holding the bushings in between. (Alternatively, the nuts may be dispensed with if the outer diameter of eye-plate bushing is slightly different from the diameter of the fork-end bushings.)

The shearing edges of the shackle/bushings should have a hardness of not less than 530 *HV*. Suitable hardened steel bushes may also be used for different sizes of materials to be tested. Figures 1 and 2 show test rigs suitable for conducting shear test with tensile and compressive loads, respectively.

5.3 Test Procedure — The specimen is placed in the test rig, assembled as in Fig. 1 or Fig. 2, and loaded at a uniform rate until complete failure occurs. The maximum load to fracture the specimen is determined by direct reading on the testing machine, and the shear strength is obtained from maximum load in accordance with the formula given in **3.1.**

5.3.1 The speed of testing or the rate of separation of the cross-heads, at any moment during the test, shall not be greater than 10 mm/min.

6. TEST REPORT

6.1 The test report shall include the following for each specimen tested :

a) Shear test method,

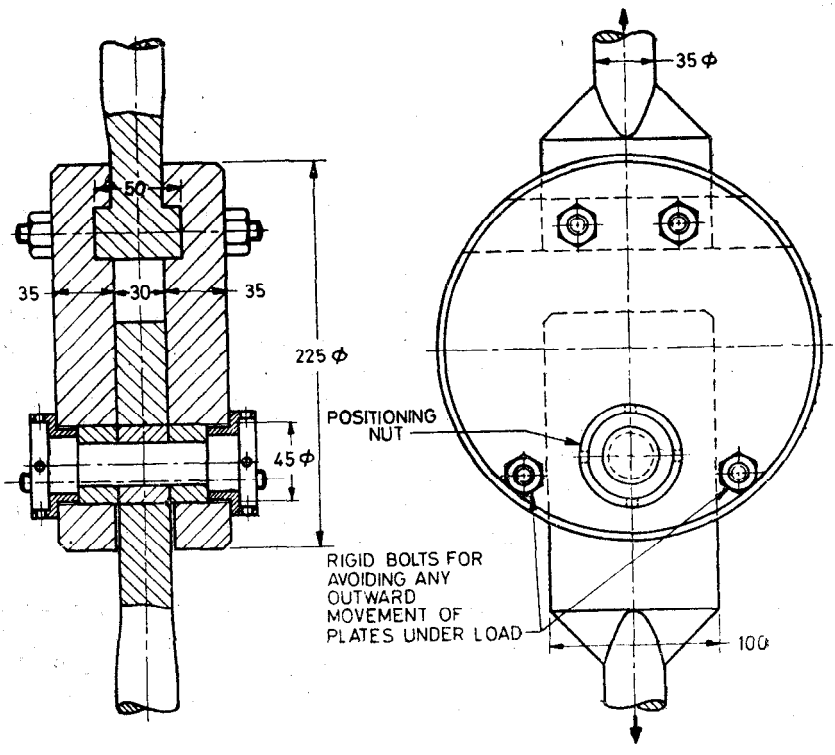
b) Material and sample identification,

c) Specimen diameter (mm),

d) Maximum load (N), and

e) Shear Strength (MPa).

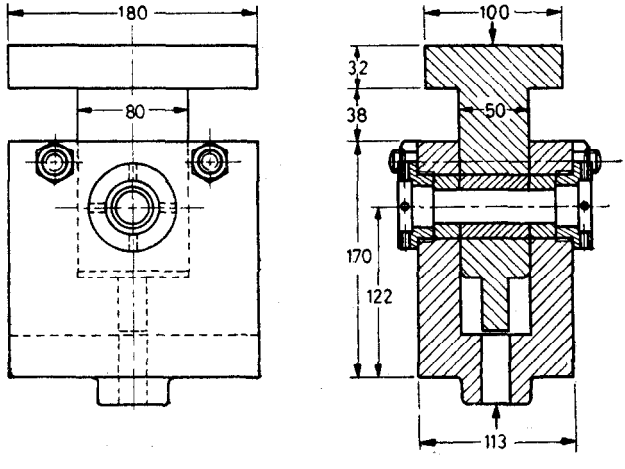
*Method for load verification of tensile testing machines (*first revision*).



NOTE — The test-piece size shall be within $^{+0}_{-0.05}$ mm of the bore of the bush.

All dimensions in millimetres.

FIG. 1 TEST RIG FOR CONDUCTING SHEAR TEST UNDER A TENSILE LOAD



All dimensions in millimetres.

FIG. 2 TEST RIG FOR CONDUCTING SHEAR TEST UNDER A COMPRESSIVE LOAD

INTERNATIONAL SYSTEM OF UNITS (SI UNITS)

Base Units

Quantity	Unit	Symbol
Length	metre	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Luminous intensity	candela	cd
Amount of substance	mole	mol

Supplementary Units

Quantity	Unit	Symbol
Plane angle	radian	rad
Solid angle	steradian	sr

Derived Units

Quantity	Unit	Symbol	Definition
Force	newton	N	$1\ N = 1\ kg.m/s^2$
Energy	joule	J	$1\ J = 1\ N.m$
Power	watt	W	$1\ W = 1\ J/s$
Flux	weber	Wb	$1\ Wb = 1\ V.s$
Flux density	tesla	T	$1\ T = 1\ Wb/m^2$
Frequency	hertz	Hz	$1\ Hz = 1\ c/s\ (s^{-1})$
Electric conductance	siemens	S	$1\ S = 1\ A/V$
Electromotive force	volt	V	$1\ V = 1\ W/A$
Pressure, stress	pascal	Pa	$1\ Pa = 1\ N/m^2$

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